

Patent Claims

1. A simulation method for determining nonlinear  
signal distortion in an analog circuit (7), which  
is to be tested, for processing discrete multitone  
signals (DMT), with the simulation method having  
the following steps:

(a) application of a discrete multitone signal,  
which has a large number of uniformly spaced  
carrier frequencies for data transmission in a  
predetermined frequency range, to the analog  
circuit (7), which is to be tested, and to a  
digital filter (18);

(b) suppression of the output signal from the  
analog circuit (7), which is to be tested, from  
the output signal from the digital filter (18) in  
order to produce a difference signal,

(c) adjustment of the digital filter (18) until  
the difference signal is a minimum, with the  
adjusted digital filter (18) forming an equivalent  
circuit of the analog circuit (7);

(d) application of the discrete multitone signal  
to the adjusted digital filter (18), with at least  
one carrier frequency being suppressed, for  
measuring the intermodulation product (D) of the  
adjusted digital filter (18).

2. The simulation method as claimed in claim 1,  
wherein

a multitone signal ratio is calculated from the  
measured intermodulation product.

3. The simulation method as claimed in claim 1 or 2,  
wherein

the adjustable modeling filter (18) is a  
discrete-time Volterra filter, or a neural  
network.

4. The simulation method as claimed in one of the

preceding claims,  
wherein  
the adjustable modeling filter (18) is connected  
in parallel with the analog circuit (7) which is  
to be tested.

5           5.    The simulation method as claimed in one of the  
preceding claims,  
wherein

10           the adjusted modeling filter (18), which forms an  
equivalent circuit of an analog circuit (7), is  
connected to further adjusted modeling filters,  
which form equivalent circuits of further analog  
circuits, in order to generate an overall  
15           equivalent circuit for an analog overall circuit.

6.    The simulation method as claimed in one of the  
preceding claims,  
wherein

20           the analog overall circuit is a DSL-SLIC circuit.

7.    The simulation method as claimed in one of the  
preceding claims,  
wherein

25           the discrete multitone signals are generated in a  
signal generator (1).

8.    A test arrangement for determining nonlinear  
signal distortion of analog circuit elements of a  
signal processing circuit for signal processing of  
DMT signals having:

30           (a) a signal generator (1) for producing a  
discrete multitone signal;

35           (b) adjustable modeling filters (18) which are  
each connected in parallel with an associated  
analog circuit element (7), with the signal inputs  
of the modeling filters (18) and of the analog  
circuit elements (7) being connected to the signal  
generator (1);

(c) subtraction circuits, which each subtract the output signal from a modeling filter (18) from the output signal from the associated analog circuit element (7) in order to form a difference signal;

5 (d) an adjustment circuit, which compares the difference signals with a nominal value and adjusts the modeling filters (18) until the difference signals match the nominal value; and having

10 (e) a measurement circuit, which is connected to the outputs of the modeling filters (18), for measuring the intermodulation products of the adjusted modeling filters (18).

15 9. The test arrangement as claimed in claim 8, wherein  
the test circuit is followed by a calculation  
circuit (32) for calculating the multitone signal  
power ratio of the output signals which are  
20 emitted from the modeling filter (18).

# List of reference symbols

- 1 Signal generator
- 2 Output
- 3 Line
- 4 Branch node
- 5 Line
- 6 Input
- 7 Analog test circuit
- 8 Output
- 9 Line
- 10 Input
- 11 Subtraction circuit
- 12 Output
- 13 Line
- 14 Input
- 15 Adjustment circuit
- 16 Output
- 17 Adjustment lines
- 18 Modeling filter
- 19 Input
- 20 Line
- 21 Output
- 22 Line
- 23 Branch node
- 24 Line
- 25 Input
- 26 Line
- 27 Input
- 28 Measurement circuit
- 29 Output
- 30 Line
- 31 Input
- 32 Calculation circuit
- 33 Subtraction circuit
- 34 Overall circuit